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The Great Wall for ASEAN Foreign Exchange Risk Premium

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Abstract

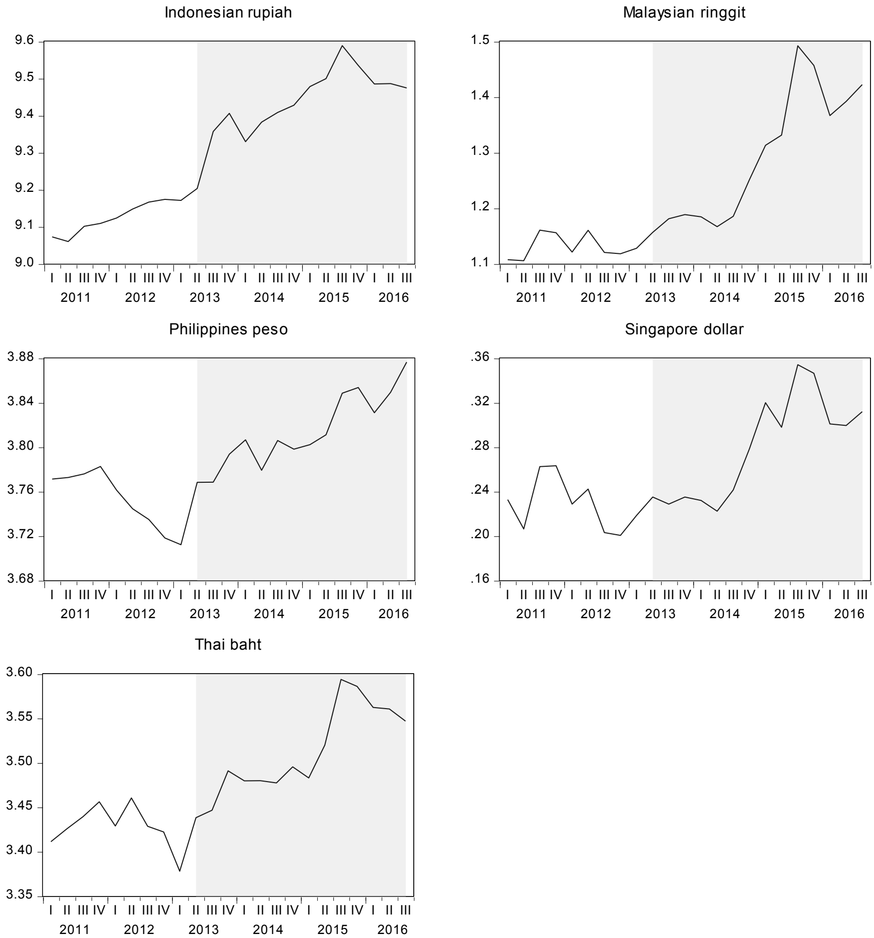
Southeast Asian currencies have been losing ground since the taper tantrum in May 2013 to an extent that goes beyond the standard explanation in yield differentials. This paper modifies the otherwise standard uncovered interest parity (UIP) relation to shed light on two mechanisms: delayed adjustment to expectation error and a risk wedge that shapes the slope of UIP. The wedge is alternatively proxied by global uncertainty, domestic fundamentals, and China's factors. Drawn on a panel sample of the five largest ASEAN economies over the period 1982Q1 to 2016Q3, we find the presence of forward discount puzzle in ASEAN-5 exchange rates against the US dollar, which cannot be explained by global uncertainty and domestic attitudes toward capital flows and exchange rate flexibility. It is China's exchange rate policy that matters, in the sense that greater flexibility in yuan-dollar exchange rates and greater US dollar weight in the renminbi's currency basket amplify regional currencies fluctuations. In view of this, any effort to stabilize regional currencies cannot afford to ignore what's going on behind the Great Wall.

Keywords: *forward discount puzzle, uncovered interest parity, China, renminbi, Southeast Asia*

1. Introduction

Currencies in developing countries have been weakening against the US dollar ever since the taper tantrum on 22 May 2013. Being one of the most open regions in the world in terms of trade and capital flows, Southeast Asia is no exception. Figure 1 vividly illustrates such seemingly unstoppable depreciation for the five largest Southeast Asian economies (ASEAN-5 hereafter). Till the announcement of the second raise in the US interest rate on 16 December 2016, the US dollar has been gaining against these regional currencies at a rate that ranges from 13 per cent (Singapore dollar) to 39

Figure 1 The "Great Depreciation" in Selected ASEAN Currencies since Taper Tantrum in May 2013



Note: The shaded area ranges from second quarter 2013 to third quarter 2016, indicating the period when the reversal in US monetary stance was first mentioned in May 2013, first US interest hike since 2009 in December 2015, and the likelihood of a second interest hike in December 2016.

per cent (Malaysian ringgit). Following signals of more tightening moves in the subsequent year, ASEAN-5 currencies are expected to get weaker for an extended period.

While it is intuitively straightforward to observe contemporaneous depreciation on impact in regional currencies against the US dollar in responding to the announcement of US interest hikes, it is unclear if the US dollar should have been appreciating over such a lengthy period. This is another demonstration against the uncovered interest rate parity (UIP) condition, which states that countries with high interest rates (or rising interest rate in the U.S context) should have *depreciating* currencies relative to currencies of countries with low interest rates (see Engel, 2014 & 2016 for a detailed discussion on this "forward premium puzzle"). It also seems hard to make sense of the magnitude of ASEAN currencies depreciation with the change in interest rate differentials when one thinks of the Malaysian ringgit depreciation by 39 per cent over the period of twice US interest hikes by merely 0.5 percentage point in total. Can the depreciating regional currencies really be accounted for by the unfavourable interest rate differentials? Is there a risk factor that constitutes wedge between domestic and foreign assets? If yes, what form the risk?

This paper addresses these questions by using the UIP framework. Through a simple rearrangement, we are able to quantify the responses of exchange rates to interest rate differentials on top of the speed of adjustment to expectation error. At the same time, in the spirit of the solution to forward premium puzzle available in the literature that pays attention to the presence of risk premium in UIP relation, we model risk not as an independent variable in the model but as a wedge that shapes the slope of UIP. We alternatively consider if global uncertainty, domestic fundamentals in terms of regional central banks' preference to intervene in foreign exchange market and capital account openness, and China's exchange rate policies, which we focus on the de facto flexibility in the renminbi and the U.S dollar weight (the dollar weight hereafter) in the renminbi's currency basket, play the role as risk wedge. The model is taken to a panel data of ASEAN-5 over the period 1982Q1 to 20116Q3.

The findings can be wrapped up as four takeaways:

i) Adjustment to expectation error is slow. Although it is statistically significant, it is by itself insufficient to explain the puzzling UIP relation.
ii) Global uncertainty, measured by VIX index and the US economic policy uncertainty index, is not always statistically significant with meaningful magnitude, and is thus unable to account for the orderly depreciating ASEAN-5 currencies given the yield differentials.
iii) Although regional central banks' willingness to let their respective currencies float instead of being intervened through the sales of international reserves does cause exchange rates to fluctuate more than what can be accounted by yield differentials, a piece of evidence in line with Aizenman and Hutchison (2012), and it is statistically significant, it fails to rationalise the UIP relation.
iv) By incorporating China's exchange rate policy as the risk wedge, the model successfully delivers a statistically and economically sensible

UIP relation in that higher (or rising)-yielding currency is appreciating. More interesting, it also demonstrates how China's policy has amplified ASEAN-5 currencies variations in the sense that greater yuan-dollar exchange rate flexibility and rising dollar weight make ASEAN-5 riskier.

The last finding is especially instrumental to point out a fact that any effort by the regional central banks to soothe exchange rate fluctuations in the face of US interest hike cannot ignore exchange rate policy implemented by the People's Bank of China (PBOC). Given the heavy dependence of ASEAN trade dynamics on China, not to speak of the growingly gaining currency investment flows, PBOC's exchange rate reform that allows the renminbi to be more flexible with market-determined central parity resembles massive waves that lift and sink all neighbouring boats along.

This paper can be positioned in two important yet independent literatures, and sows the seeds that could link both literatures fruitfully. On one spectrum, this paper contributes to the "forward discount puzzle" literature by proposing an innovatively simple way to restructure UIP relation for estimation. On another spectrum, this paper enriches the empirical literature with respect to the macroeconomic impact of Chinese economy on the world economy. Instead of focusing on international trade linkages (see, for instance, Eichengreen, Rhee, & Tong, 2007; Greenaway, Mahabir, & Milner, 2008; Wong, Eng, & Habibullah, 2014), we shed light on the impact of China's exchange rate policy on the UIP relation in ASEAN-5. By doing so, this paper links the latter literature to the former by suggesting the importance of exchange rate policy or reform in a large open economy like China as the source of excess risk premium for currencies in small open economies like ASEAN-5.

The paper is organised as follows. We present a framework for empirical investigation in Section 2, and from there we lay out the expectation adjustment term and risk wedge that shapes the slope of UIP relation. In Section 3, we discuss the data used for estimation. Findings are discussed in Section 4, in which we show the role of China's exchange rate policy as a source of risk wedge. We conclude in Section 5.

2. Framing the Empirical Investigation

We start the discussion by resorting to the standard empirical uncovered interest parity (UIP) relation as what follows:

$$\mathbb{E}_t LS_{it+1} - LS_{it} = \alpha_i + \beta(r_{it} - r_t^*) + u_{it} \tag{1}$$

where r_{it} and r_t^* denotes country i and US interest rate, respectively, LS_{it} is the logarithmic form of nominal exchange rate between country i and the US, defined as country i's currency value for the unit of the US dollar (higher LS_{it} thus implies depreciation in country i's currency), $\mathbb{E}_t$ is expectation operator, and u is error term.

According to Equation (1), while higher-yielding currency should have appreciated on impact, it also means expected depreciation over time. In a perfectly rational asset market with perfect information, *ex post* exchange rates movement shall reflect accurately *ex ante* expectation. In other words, higher-yielding currency should be associated with depreciating currencies. In the context of estimation, one should empirically obtain $\beta = 1$ and $\alpha_i = 0$.

However, like other puzzles in international macroeconomics, we do not always get what we hope for. Years of empirical findings have pointed to a puzzling negative β (see, for instance, surveys by Engel, 2014). Despite the fact that UIP relation remains one of the most widely used exchange rate determination model in international macroeconomics, Chinn and Meridith (2004) called it "at best useless – or at worst perverse – as a predictor of future exchange rate movements". Since then, literature that aims to resolve the puzzle has been blossoming (see, for instance, Froot & Thaler, 1990, Eichenbaum & Evans, 1995 and Bacchetta & van Winchoop, 2010 for the idea of "delayed overshooting"; and Frankel & Meese, 1987, Engel & West, 2004, Evans, 2012 for "exchange rate risk premium"; and Lothian, 2016).

To deal with the potential issue of puzzle, we make two small innovations. First, we rewrite Equation (1) so that

$$\mathbb{E}_t LS_{it+1} - LS_{it-1} - (LS_{it} - LS_{it-1}) = \alpha_i + \beta(r_{it} - r_t^*) + u_{it}$$

to get

$$\Delta S_{it}(\equiv LS_{it} - LS_{it-1}) = -\alpha_i + \mathbb{E}_t LS_{it+1} - LS_{it-1} - \beta(r_{it} - r_t^*) + u_{it}$$

or in reduced form

$$\Delta S_{it}(\equiv LS_{it} - LS_{it-1}) = \rho_{i0} + \rho_1 ExpErrorAdj_{it} + \rho_2(r_{it} - r_t^*) + u_{it} \quad (2)$$

where $ExpErrorAdj_{it} = \mathbb{E}_t LS_{it+1} - LS_{it-1}$, $\rho_{i0} = \alpha_i$, $\rho_1 = 1$, and $\rho_2 = -\beta$. We hypothesize that

i) With perfect-foresight agents and without government policy intervention, there is no rate of depreciation misaligned with *ex ante* expectation, $\rho_{i0} = 0$.
ii) For currency overvalued (undervalued) relative to long-run expected value, currency adjusts through depreciation (appreciation), $\rho_1 = 1$. For $0 < \rho_1 < 1$, it indicates "delayed adjustment" in the sense of Eichenbaum and Evans (1995) and Bacchetta and van Winchoop (2010).
iii) High interest rate currency relative to the US interest rate is associated with appreciation, $\rho_2 < 0$. This indicates the absence of forward discount

puzzle as $\rho_2 < 0$ implies $\beta > 0$. Purely fundamental-driven exchange rates with no excessive volatility will give us $\rho_2 = -1$.

What are the factors that shape the slope of UIP? Do reactions of exchange rates toward interest differentials depend on the reform in China's exchange rates? As the second innovation in estimation, which we draw upon the approach employed in Han and Wei (2016), we suppose the interaction between exchange rates movements and interest differentials is shaped by global uncertainty, domestic fundamentals, and China's factors as what follows

$$\rho_2 = \varphi_{i0} + \underbrace{\sum_{j=1}^{2} \phi_j X_{j,t}}_{\substack{Global \\ uncertainty}} + \underbrace{\sum_{k=1}^{K} \chi_k Y_{k,it}}_{\substack{Domestic \\ fundamentals}} + \underbrace{\sum_{l=1}^{2} \psi_l Z_{l,t}}_{\substack{China's \\ factors}}$$

Expanding Equation (2) together with these factors gives us

$$\Delta S_{it} = \rho_{i0} + \rho_1 ExpErrorAdj_{it} + \varphi_{i0}(r_{it} - r_t^*) + \sum_{j=1}^{2} \phi_j X_{j,t}(r_{it} - r_t^*) +$$

$$\sum_{k=1}^{K} \chi_k Y_{k,it}(r_{it} - r_t^*) + \sum_{l=1}^{2} \psi_l Z_{l,t}(r_{it} - r_t^*) + u_{it} \quad (3)$$

where we expect $\varphi_{i0} < 0$. Now, we have global uncertainty, domestic fundamentals, and China's exchange rate policy as the risk wedges that influence the ASEAN-5's UIP slope.

3. Data

In this section we briefly describe the data we use and construct for the estimation of Equation (3). Unless otherwise mentioned, the data are all sourced from the Oxford Economics via Thompson Reuter's Datastream, and range from year 1982 to 2016 on quarterly basis. We focus on the five most developed Southeast Asian economies, which happen to be the earliest members of the Association of Southeast Asian Nations (ASEAN), namely Indonesia, Malaysia, the Philippines, Singapore and Thailand (ASEAN-5). Being an open regionalism, China and the US have been among the top three (besides Japan) most important trading partners for decades. This goes without saying that the US dollar has long been an anchor currency for ASEAN-5 exchange rate management, with the Chinese renminbi joining the currency basket in recent years (Subramanian & Kessler, 2013; see Kawai & Pontines, 2016 for a sceptical view).

Changes in exchange rates are computed using the quarterly log differences. Money market rate is used as proxy for short-term interest rate with three-month treasury bill rate as substitute in the absence of money market rate. As in the literature, we use the popular VIX, a measure of the implied volatility of S&P 500 index options, as the indicator for global uncertainty. On top of this, we take Baker, Bloom and Davis' (2016) US economic policy uncertainty index as the proxy for policy uncertainty. Both series are extracted from the St. Louis Fred database.

We assume that expected exchange rates are aligned with the fundamental equilibrium exchange rates (FEER), which we estimate using the monetary approach to exchange rates. To be more specific, the monetary model of FEER can be presented as

$$LS_{it} = \gamma_{i0} + \gamma_1(Lm_{it} - Lm_t^*) + \gamma_2(Ly_{it} - Ly_t^*) + \varepsilon_{it} \tag{4}$$

where Lm_{it}, Ly_{it}, Lm_t^* and Ly_t^* denote log money supply and real gross domestic product in country i, and that of the US, respectively. In order to capture the potential impact of changes in velocity of circulation on prices and thus exchange rates due to the evolving landscape in the financial system, M3 is used as proxy for money supply. We expect that $\gamma_1 > 0$ and $\gamma_2 < 0$, as countries with greater money supply and lacklustre economic progress will be depreciating.

Table 1 reports the panel estimation using ASEAN-5 data. Once we take into account country effects as in the within estimator model, the

Table 1 Monetary Approach to ASEAN Fundamental Equilibrium Exchange Rates

	Pooled OLS	*Within Estimator*	*GLS*
*Lm – Lm**	-1.5021**	0.7561***	0.711***
	(0.0336)	(0.0029)	(0.0000)
*Ly – Ly**	1.6203**	-1.096***	-0.886***
	(0.0209)	(0.0029)	(0.0000)
Constant	2.8495*	4.5972***	4.029**
	(0.0671)	(0.0000)	(0.0055)
Observations	700	700	700
Poolability test		23869.48***	
BP LM test	13606.41***		
Hausman test			291.2***

Note: Local currency unit per US dollar is regressed, *m** and *y** stand for US M3 and real GDP, respectively. All variables are in natural logarithm. *, ** and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively. Values in brackets are the estimated robust standard errors. Data are sourced from Oxford Economics.

results nicely fit with the theoretical motivation. Hausman test also confirms the superiority of within estimator model over the pooled OLS and GLS estimators. From within estimator, we then generate an estimated series of FEER that proxies the expected exchange rates, $\mathbb{E}_t LS_{it+1} = \widehat{LS}_{it}$, where

$$\widehat{LS}_{it} = \hat{\gamma}_{i0} + \hat{\gamma}_1(Lm_{it} - Lm_t^*) + \hat{\gamma}_2(Ly_{it} - Ly_t^*)$$

By doing so, we implicitly assume a perfectly rational foreign exchange market. Even so, the findings we discuss in the next section show there is a delay in adjustment to deviation from the fundamental equilibrium.

Turning to domestic fundamentals, we focus on two dimensions. First is the capital account openness. Whether changes in interest differentials instigate fluctuations in exchange rates relies on capital flows across borders as a response. The latter in turn depends on the openness of capital account. We resort to Chinn and Ito's (2006) widely used *de jure* measure of a country's degree of capital account openness (*KAOPEN*) as a proxy. *KAOPEN* is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. The index is normalized to range between zero (closed capital account) and one (unrestricted capital account).

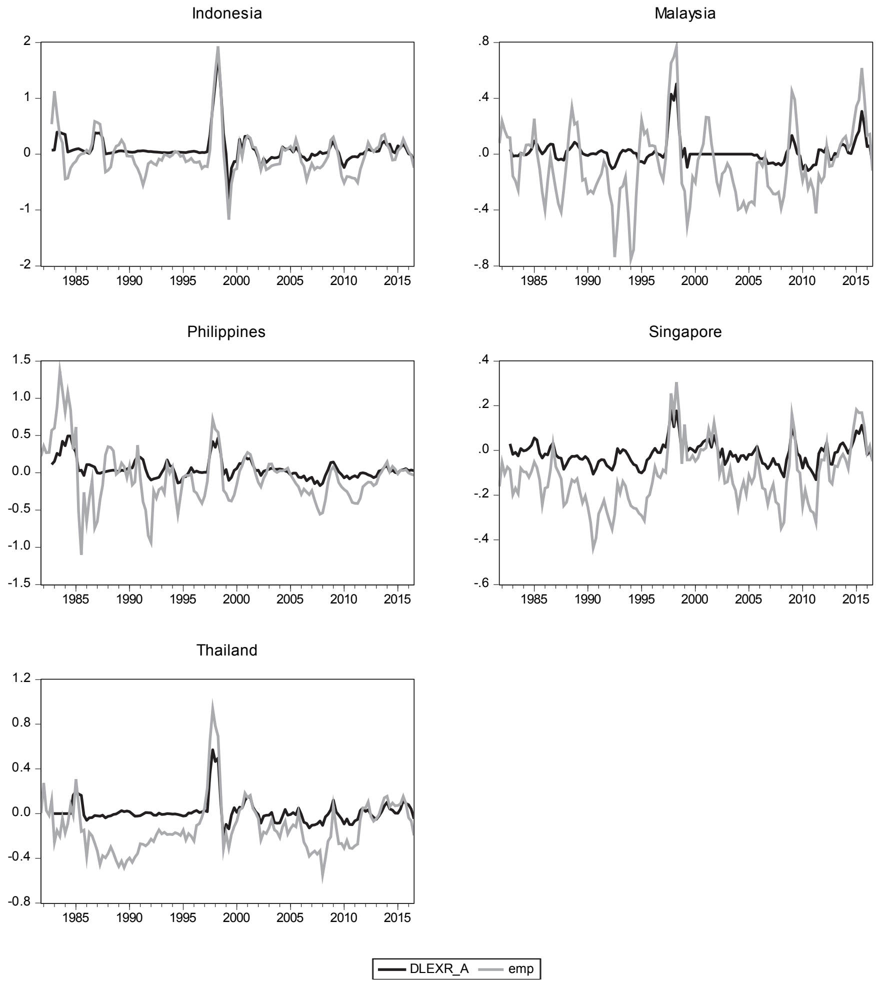
Another domestic fundamental which we think may alter directly the slope of UIP is the change in exchange market pressure ΔEMP. According to Frankel (2009), increase in international demand for the ASEAN-5 currencies may show up either in the price of the ASEAN-5 currencies or the quantity of the ASEAN-5 currencies. ΔEMP can be defined as

$$\Delta EMP_{it} \equiv \Delta LS_{it}^a + \Delta LIntRes_{it} \quad (5)$$

where ΔLS_{it}^a denotes year-to-year change in log exchange rates, whereas $\Delta LIntRes_{it}$ stands for year-to-year change in log international reserves of country i. Changes in exchange market pressure interestingly depend on the policies of the ASEAN-5 monetary authorities. If the authority chooses not to intervene in market transaction of ASEAN-5 currencies, ΔEMP largely reflects price pressure. Alternatively, the authority can alter quantity of international reserves by selling (buying) reserves to neutralise depreciation (appreciation), easing exchange market pressure.

Figure 2 illustrates the exchange market pressure alongside changes in exchange rates. Interestingly, it can be seen that price pressure during the 1997/98 Asian currency and financial crises was simply too huge to be moderated by changes in international reserves. In consequence, ΔEMP moves closely with ΔLS_{it}^a. Same phenomenon can be largely observed during the 2007/2008 global financial crisis, where ASEAN-5 monetary authorities

Figure 2 Exchange Market Pressure Facing the ASEAN-5



Note: dlexr_a = year-to-year changes in log exchange rates, emp = changes in exchange market pressure.

are more willing to let market pressure out through price changes. “Fear of floating” seems to give way to what Aizenman and Hutchison (2012) call “fear of reserve loss”. Nonetheless, leaving aside these two unprecedented shocks, quantity intervention seems to remain as a popular tool to moderate fluctuations in exchange rates. By having more frequent episodes of negative ΔEMP alongside a relatively more stable exchange rate, in particular, this shows the tendency to stem depreciation while tolerating appreciation.

The last group of driving forces, which happens to be the focus of this paper, is China's exchange rate policy. We propose three measures with respect to *anchor*, *flexibility* and *volatility*. China has been reforming its exchange rate regime from unilateral dollar peg to crawling peg after July 2005 and managed floating with reference to a basket of currencies after June 2010. To find out the evolving weight of anchor currencies for the renminbi, which reflects the de facto China's exchange rate regime, we adopt the widely used Frankel and Wei's (1994, 2007) estimation.

$$\Delta S_{\frac{CNY}{NZD},t} = \phi_0 + \phi_{1,t}\Delta S_{\frac{U\$}{NZD},t} + \phi_{2,t}\Delta S_{\frac{euro}{NZD},t} + \phi_{3,t}\Delta S_{\frac{JPY}{NZD},t} + \phi_{4,t}\Delta S_{\frac{GBP}{NZD},t} + \nu_t \quad (6)$$

We follow Kawai and Pontines (2016) to use the New Zealand dollar as numeraire currency because it is a freely floating international currency without being weighted in the currency baskets of the ASEAN economies. However, even if the usual Swiss franc is used as the numeraire currency, the qualitative results remain the same with no significant differences in the quantitative measurement. Equation (6) is estimated on a rolling basis with window size of twenty quarters. Figure 3 illustrates the time-varying dollar weight and euro weight for Equation (6) and the expanded Equation (6) with changes in China's exchange market pressure (see Frankel, 2009). Although dollar weight has been declining since the abandonment of dollar peg in 2005, the US dollar remains the decisive anchor currency for the renminbi. Meanwhile, the importance of euro has been weakening since the onset of Eurozone debt crisis.

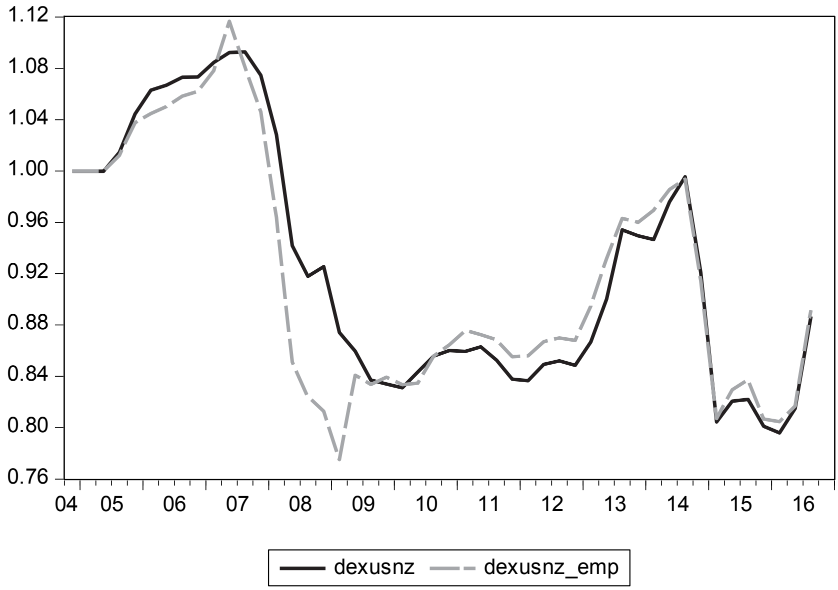
Lastly, flexibility and volatility of the renminbi are measured by quarter-to-quarter changes in yuan-dollar exchange rates and four-quarter moving average standard deviation of changes in yuan-dollar exchange rates, respectively.

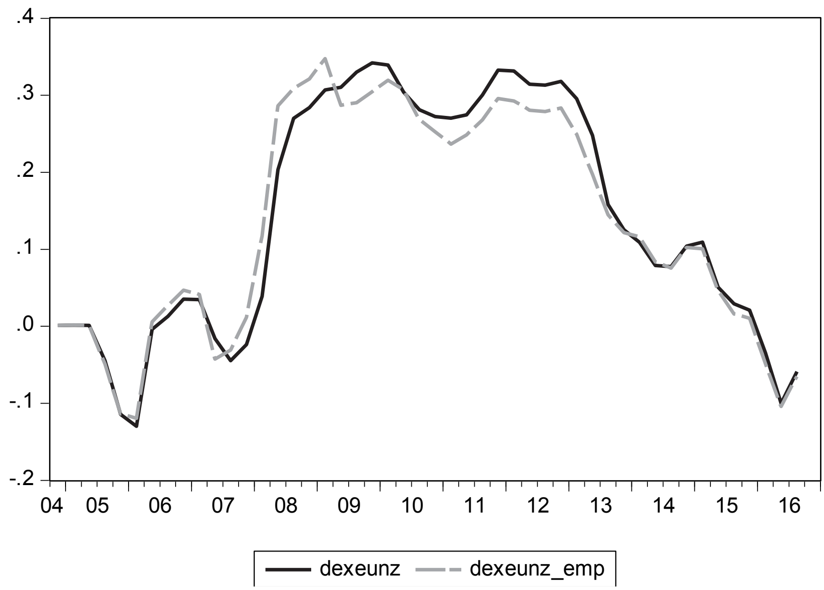
4. Results Discussion

We first estimate a standard UIP relation as in Equation (2). We then estimate the expanded UIP model that incorporates global uncertainty in both level and first difference. We run through three different estimators from pooled OLS to within and GLS estimators with robust standard errors. Results are reported in Table 2. Statistical comparison of models generally points to the superiority of within estimator that considers specifically country effect.

The finding is obvious: forward discount puzzle is present in ASEAN-5 UIP relations. Adjustment of expectation deviation is slow in speed and insignificant statistically. Intercept is nonzero with statistical significance.

Figure 3 Time-Varying Weights of the U.S Dollar and Euro in RMB's Currency Basket, 2004Q4 – 2016Q3





Note: *dexeunz* = time-varying weight of changes in euro in the RMB's currency basket, where *dexusnz* = time-varying weight of changes in the US dollar. The numeraire currency is New Zealand dollar; *dexeunz_emp* and *dexusnz_emp* are the rolling weights that take exchange market pressure (emp) into account. The numeraire currency is New Zealand dollar. Windows = 20 quarters.

Table 2 ASEAN-5 Exchange Rate Variation Unexplained by Global Factors, 1982Q1-2016Q3

	UIPC			*Global Factors-Level*			*Global Factors-First Difference*		
	POLS	*Within Estimator*	*GLS*	*POLS*	*Within Estimator*	*GLS*	*POLS*	*Within Estimator*	*GLS*
$\widehat{LS}_t - LS_{t-1}$	-0.0012 (0.1502)	0.065* (0.0781)	-0.0012*** (0.0000)	-0.0014 (0.1755)	0.0808** (0.0321)	-0.0014*** (0.0011)	-0.0009 (0.3782)	0.0873** (0.0165)	-0.0009* (0.0968)
$r - r^*$	0.0693 (0.1574)	0.0558 (0.394)	0.0693*** (0.0084)	0.903*** (0.000)	0.5754*** (0.0016)	0.9030*** (0.000)	0.0666 (0.2848)	0.0147 (0.830)	0.0666 (0.1069)
Interaction between Interest Differentials and Global Factors									
$VIX \times (r - r^*)$				-0.0037 (0.5525)	0.0044 (0.245)	-0.0037 (0.6053)			
$EPU^* \times (r - r^*)$				-0.0079*** (0.000)	-0.0070*** (0.0021)	-0.0079*** (0.000)			
$\Delta VIX \times (r - r^*)$							0.1289 (0.6878)	0.0986 (0.7157)	0.1289 (0.6964)
$\Delta EPU^* \times (r - r^*)$							-0.459 (0.1454)	-0.3047* (0.0514)	-0.4695*** (0.0006)
Constant	0.0054* (0.0632)	0.0053** (0.0449)	0.0054*** (0.000)	0.0052 (0.1241)	0.0047** (0.0373)	0.0052*** (0.0005)	0.0039 (0.2418)	0.0027 (0.1053)	0.0039** (0.0252)
N	695	695	695	535	535	535	530	530	530
Poolability Test		7.14***			6.66***			7.81***	
BP LM Test	0.00			0.00			0.00		
Hausman Test			27.29***			25.55***			29.7***

Note: Change in local currency unit per US dollar is regressed. Values in brackets are estimated cluster-robust standard errors. $\widehat{LS}_t$ is the estimated fundamental ASEAN exchange rates based on Equation (4). r^* refers to US interest rates. *VIX*, which measures the implied volatility of S&P 500 index option, is a proxy for global risk appetite, and *EPU** measures US economic policy uncertainty (Baker et al., 2016). *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Controlling for global uncertainty in the estimation apparently cannot resolve the puzzle. While global uncertainty is statistically insignificant, and interestingly, greater economic policy uncertainty appreciates higher-yield currency. This seems contradictory to the usual finding that greater policy uncertainty that causes risk off episodes is associated with depreciation (see, for instance, Kido, 2016).

One encounters the same problem when domestic fundamentals are controlled for either independently or together with global uncertainty, as reported in Table 3. Although change in exchange market pressure explains well ASEAN-5 currencies movement, as greater pressure with lesser reserve

Table 3 ASEAN-5 Forward Premium Puzzle also Unexplained by Domestic Factors, 1982Q1-2016Q3

	Domestic factors			*Domestic cum global factors*		
	POLS	*Within Estimator*	*GLS*	*POLS*	*Within Estimator*	*GLS*
$\tilde{LS}_t - LS_{t-1}$	-0.0022***	0.086*	-0.0022**	-0.0032***	0.1026**	-0.0032*
	(0.0108)	(0.0899)	(0.0249)	(0.0016)	(0.0377)	(0.0803)
$r - r^*$	-0.1867	0.0139	-0.1867	0.3900	0.3572	0.3900
	(0.1237)	(0.9734)	(0.6664)	(0.1556)	(0.5439)	(0.4927)
Interaction between Interest Differentials and Domestic Factors						
$KAOPEN \times$	0.0895	-0.2425	0.0895	0.3133	-0.2088	0.3133
$(r - r^*)$	(0.4722)	(0.4537)	(0.7993)	(0.1334)	(0.6593)	(0.5489)
$\Delta EMP \times$	0.3579***	0.4063*	0.3579**	0.6074***	0.6883**	0.6074**
$(r - r^*)$	(0.000)	(0.0819)	(0.0179)	(0.000)	(0.0405)	(0.0142)
Interaction between Interest Differentials and Domestic cum Global Factors						
$VIX \times$				-0.0141**	-0.0113**	-0.0141**
$(r - r^*)$				(0.0361)	(0.0336)	(0.0155)
$EPU \times$				-0.0067***	-0.0041***	-0.0067***
$(r - r^*)$				(0.0005)	(0.0011)	(0.000)
Constant	0.0091***	0.0062	0.0091*	0.0122***	0.0091	0.0122
	(0.0026)	(0.2557)	(0.0793)	(0.0009)	(0.2867)	(0.1485)
N	692	692	692	535	535	535
Poolability Test		11.08***			10.68***	
BP LM Test	0.00			0.00		
Hausman Test			41.87***			39.8***

Note: Values in brackets are estimated cluster-robust standard errors. *KAOPEN* refers to Chinn-Ito capital account openness index (Chinn & Ito, 2006), and ΔEMP refers to change in exchange market pressure that measures exchange rate flexibility (the degree of central bank's fear of floating) according to Equation (5). The rest are as in Table 2.

Table 4 China's Exchange Rate Policy Does Matter

	US$ Weight in RMB's Basket			*RMB Flexibility*			*RMB Volatility*		
	POLS	*Within Estimator*	*GLS*	*POLS*	*Within Estimator*	*GLS*	*POLS*	*Within Estimator*	*GLS*
$\widehat{LS}_{it} - LS_{it-1}$	-0.0012	0.1065**	-0.0012	-0.0013	0.1065**	-0.0013	-0.0013	0.1065**	-0.0013
	(0.2314)	(0.0354)	(0.1217)	(0.2208)	(0.0351)	(0.1151)	(0.2321)	(0.0352)	(0.136)
$r - r^*$	-0.3283*	-0.5621	-0.3284***	-0.3537**	-0.5914*	-0.3537***	-0.3396*	-0.5909*	-0.3396***
	(0.0762)	(0.1044)	(0.000)	(0.065)	(0.0916)	(0.000)	(0.0842)	(0.0961)	(0.000)
Interaction between Interest Differentials and Renminbi									
$\omega_{U\$} \times (r - r^*)$	0.3159**	0.4553**	0.3159***	0.3334**	0.4756**	0.3334***	0.3249**	0.4752**	0.3249***
	(0.0221)	(0.0262)	(0.0003)	(0.0191)	(0.0226)	(0.0001)	(0.0248)	(0.0235)	(0.000)
$\Delta LS_{yd} \times (r - r^*)$				0.4793	0.5463***	0.4793***	0.5953	0.5508**	0.5953***
				(0.6041)	(0.0017)	(0.0036)	(0.5483)	(0.048)	(0.0008)
$\sigma(\Delta LS_{yd}) \times (r - r^*)$							-0.0959	-0.0037	-0.0959
							(0.7449)	(0.9827)	(0.4476)
Constant	0.0051	0.0038	0.0051**	0.0052	0.0038	0.0052**	0.0052	0.0038	0.0052**
	(0.1439)	(0.2032)	(0.041)	(0.1393)	(0.1931)	(0.0397)	(0.1426)	(0.1964)	(0.0445)
N	505	505	505	505	505	505	505	505	505
Poolability Test		10.86***			10.86***			10.81***	
BP LM Test	0.00			0.00			0.00		
Hausman Test			40.19***			40.27***			40.1***

Note: Values in brackets are estimated cluster-robust standard errors. $\omega_{U\$}$ is the US$ weight in renminbi's currency basket obtained through rolling regression *à la* Frankel and Wei (1994, 2007) of changes in Chinese yuan on changes in the U.S dollar and other major international currencies against the New Zealand dollar. ΔLS_{yd} refers to quarterly changes in yuan-dollar exchange rate that measures RMB flexibility, and $\sigma(\Delta LS_{yd})$ denotes 4-quarter moving standard deviation of changes in yuan-dollar exchange rates that measures RMB volatility. The rest are as in Table 2.

intervention results in relative price adjustment, forward discount puzzle persists. Also, ASEAN-5 currencies still puzzlingly behave as "safe haven currency" during elevated policy uncertainty.

We turn to China's exchange rate policy in Table 4. We first check the influence of the renminbi's dollar weight. Added to subsequent analysis is the renminbi flexibility, and last the renminbi volatility. Surprisingly, the puzzle disappears. Expanding interest differentials now appreciates the higher-yielding currencies, while holding other factors constant. We also found a delayed adjustment to expectation deviation. Size of these coefficients is economically meaningful and statistically significant.

More interestingly, Chinese exchange rate policy alters the slope of and shifts ASEAN-5's UIP relation. Although expanding interest differentials appreciates the higher-yielding currency, the effect diminishes along with greater renminbi's dollar weight and more flexible yuan-dollar exchange rates. Speaking differently, holding interest differentials constant, increasing dollar weight in the renminbi's currency basket and flexibility in yuan-dollar rates sink ASEAN-5 currencies.

To check for robustness, we take a different vantage point by examining excess risk premium in ASEAN-5 currencies in the spirit of Evans (2012) and Engel (2016). We define excess risk premium as $ER_{it} \equiv \Delta S_{it} - (r_{it} - r_t^*)$. Formally, we deduct interest differentials from both sides of Equation (2) to get

$$ER_{it} = \rho_{i0} + \rho_1 ExpErrorAdj_{it} + \phi(r_{it} - r_t^*) + u_{it} \tag{7}$$

where $\phi = \rho_2 - 1$. Hence, estimated results free of forward discount puzzle are obtained when $\phi < -1$. This is exactly what can be found in Table 5. By controlling for Chinese exchange rate policy, the coefficient ϕ estimated using the preferable within estimator is smaller than –1 with strong statistical significance. The renminbi's dollar weight and flexibility are critical driving forces for excess risk premium in ASEAN-5 exchange rates against the US dollar. The inclusion of domestic fundamentals weakens the results, whereas taking global uncertainty into consideration makes the results irrelevant.

5. Conclusion

Motivated by the persistent weakening of exchange rates in Southeast Asia in the aftermath of the US monetary policy reversal, this paper intends to investigate to what extent the changes in exchange rates can be explained by interest rate differentials. Drawn upon the observations of a panel sample of selected Southeast Asian economies, perhaps unsurprisingly, interest differentials fail to account for the exchange rate movements in terms of direction and magnitude.

Table 5 China Factors and Excess Risk: A Robustness Check

	China Factors			*China and Domestic Factors*			*All Factors*		
	POLS	*Within Estimator*	*GLS*	*POLS*	*Within Estimator*	*GLS*	*POLS*	*Within Estimator*	*GLS*
$L\tilde{S}_t - LS_{t-1}$	-0.0013	0.1065**	-0.0013	-0.0029***	0.1251**	-0.0029	-0.0032***	0.1086**	-0.0032
	(0.2321)	(0.0352)	(0.136)	(0.0058)	(0.0351)	(0.2265)	(0.0026)	(0.0277)	(0.1443)
$r - r^*$	-1.3396***	-1.5909***	-1.3396***	-1.8966***	-1.4338	-1.8966*	-0.7357	-0.6112	-0.7357
	(0.000)	(0.0043)	(0.000)	(0.000)	(0.1329)	(0.0508)	(0.1253)	(0.2244)	(0.1533)
$\omega_{U\$}$	0.3249**	0.4752**	0.3249***	0.1274	0.0513	0.1274***	0.2477	0.1184	0.2477
	(0.0248)	(0.0235)	(0.000)	(0.4428)	(0.2926)	(0.0054)	(0.3684)	(0.4699)	(0.2753)
ΔLS_{yd}	0.5953	0.5508**	0.5953***	0.4534	0.5213	0.4534	0.3867	0.4590	0.3867
	(0.5483)	(0.048)	(0.0008)	(0.6377)	(0.1833)	(0.1134)	(0.6825)	(0.2758)	(0.2275)
$\sigma(\Delta LS_{yd})$	-0.0959	-0.0037	-0.0959	0.1295	0.0546	0.1295	-0.0368	-0.0522	-0.0368
	(0.7449)	(0.9827)	(0.4476)	(0.6596)	(0.8697)	(0.7552)	(0.8986)	(0.8379)	(0.8977)
$KAOPEN \times (r - r^*)$				0.5587**	-0.1379	0.5587	0.3649	-0.2133	0.3649
				(0.0255)	(0.8169)	(0.483)	(0.1383)	(0.6489)	(0.5189)
$\Delta EMP \times (r - r^*)$				0.5749***	0.6878*	0.5749*	0.6062***	0.6995**	0.6062**
				(0.000)	(0.0562)	(0.0609)	(0.000)	(0.0436)	(0.0287)
$VIX \times (r - r^*)$							-0.0234**	-0.0156*	-0.0234***
							(0.0415)	(0.0776)	(0.0001)
EPU* × $(r - r^*)$							-0.0070**	-0.0053**	-0.007***
							(0.0201)	(0.0211)	(0.0051)
Constant	0.0052	0.0038	0.0052**	0.013***	0.0086	0.013	0.0124***	0.0088	0.0124
	(0.1426)	(0.1964)	(0.0445)	(0.0008)	(0.3762)	(0.2448)	(0.0012)	(0.3029)	(0.1857)
N	505	505	505	505	505	505	505	505	505
Poolability test		10.81***			14.61***			10.98***	
BP LM test	0.00			0.00			0.00		
Hausman test			40.1***			52.66***			40.64***

Note: For notations, please refer to Tables 2 to 4.

Even when global uncertainty and central banks' stance toward more open capital account and less market intervention are taken into consideration, the puzzle remains, which brings us to the role of China's exchange rate policy. The latter is important not only in resolving the puzzle, producing theoretically coherent estimates on the relationship between interest differentials and exchange rate movements, but at the same time is also a wedge that explains the excess currency risk for Southeast Asia. We view this finding as a reminder to regional central banks to take China's exchange rate policy seriously in the effort to curb excessive exchange rate fluctuations in the face of U.S interest hike (see Wong & Eng, 2017, for cross-border macroeconomic implications of the renminbi reform).

Notes

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